network

Flashlink User Manual

SDI-TD-MUX-4

4 x SD-SDI / DVB-ASI to HD-SDI Time Division Multiplexer

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Rev. 8

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Revision history

Current revision of this document is the uppermost in the table below.

Revision	Replaces	Date	Change description
8	7	2008-11-10	Clarified max 35 Mbps active transport rate for DVB-ASI.
7	6	2008-11-04	Corrected GPI allocation (GPI0 and GPI1 was swapped and GPI2 and GPI3 was also swapped).
6	5	2008-04-08	Added text in chapter 1.3 (unused input termination). Added Declaration of Conformity.
5	4	2007-10-29	New front page.
4	3	2007-10-08	Added Materials Declaration and EFUP
3	2	2006-12-22	Moved Specifications chapter to chapter 2.
2	1	2006-11-21	New DIP-switch functionality. GYDA renamed to GYDA-SC. Can run on a single 5V supply too.
1	0	2006-09-28	Updated data for typical cable length
0	-	2006-09-21	Initial revision

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1 Product overview

The SDI-TD-MUX-4 is a Flashlink time-division multiplexer (TDM) for four SD-SDI or DVB-ASI inputs for signal transport in a single HD-SDI optical or electrical output according to the SMPTE 346M-2000 standard. Use the SDI-TD-DMUX-4 board for de-multiplexing the HD-SDI signal.

1.1 Main features

- Accepts any synchronous or asynchronous SD-SDI 270 Mbps input format as well as 270 Mbps DVB-ASI (max active data rate = 35 Mbps for DVB-ASI).
- Automatic input format detection for each channel.
- Mix of input formats allowed and correct format regained at demultiplexer (separate module; SDI-TD-DMUX-4).
- Built-in routing switcher for allocating input signals to output streams.
- Four separate and independent streams in the output HD-SDI output signal are used; allowing uninterrupted signal transport of remaining signals on loss of input feed.
- Separate stream clock reference data for each channel is transferred for remote clock regeneration.
- Optical and electrical 1.485 Gbps HD output TDM signal. Both available at all times.
- High performance optics for short and long haul applications including CWDM laser option.
- The output signal is compliant with the SMPTE-346M-2000 standard, allowing use of a standard HD infrastructure for transport and switching of the multiplexed signal.
- EDH handling for the SD-SDI signals.
- GYDA-SC interface allows remote control, status monitoring, error reporting and SNMP support.

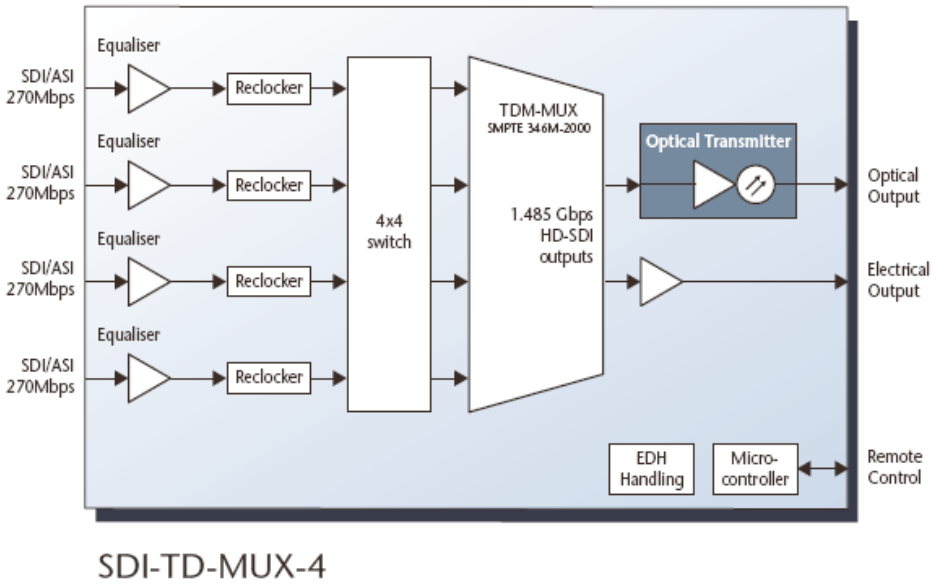


Figure 1: Block Diagram for SDI-TD-MUX-4

Front view

There will be a frame front covering the board and the on-board DIP-switches are then inaccessible (cover can however be opened). The LED's are visible through the front panel by use of integral optical guides in the front panel, as shown in Figure 2.

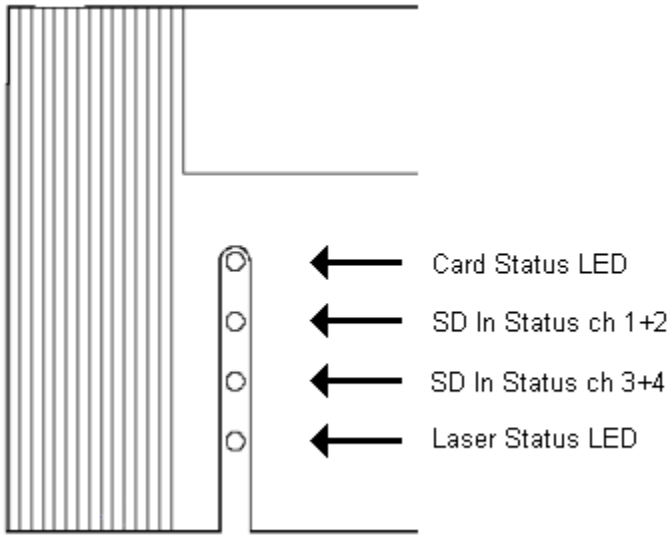


Figure 2: Front Panel View with LED Indicators (only leftmost rack position shown)

Figure 3 shows a sketch of the SDI-TD-MUX-4 board. The front view will be towards the left side of the board. The DIP switches and the LED's are the only parts of interest for the user.

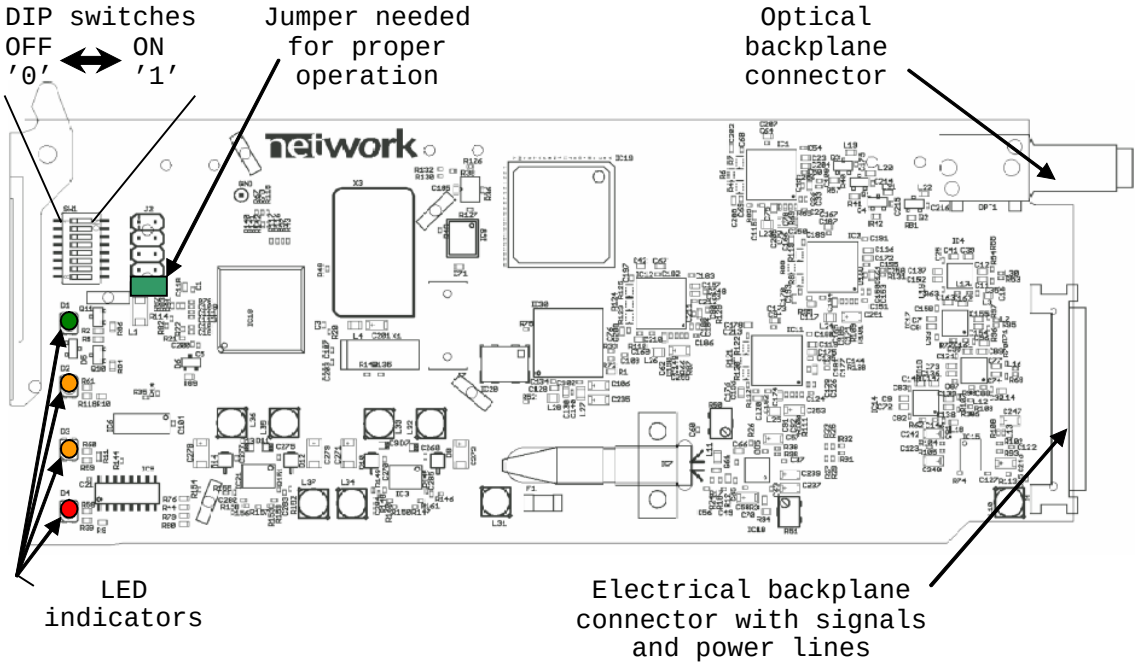

DIP switches
OFF ’0’ ON ’1’
Jumper needed for proper operation
Optical backplane connector
LED indicators
Electrical backplane connector with signals and power lines

Figure 3: MUX Board Layout

1.2 Rear view and Connectors

The rear view of the board is towards the right side of the board, as shown in Figure 3. The board must be mounted in a Flashlink FR-2RU-10-2 frame with a dedicated backplane board for the SDI-TD-MUX-4 board.

Figure 4 shows the backplane rear view. Avoid inserting the SDI-TD-MUX-4 board into a wrong backplane board, as this may cause electrical or mechanical damage to the board.

The SD1 to SD4 inputs are for 270 Mbps SD-SDI or DVB-ASI signals.

The HD output carries the electrical HD-signal with the four input signals time division multiplexed according to the SMPTE 346M-2000 standard.

The optical and electrical outputs both carry the same HD-signal.

The GPI outputs are alarm signals for driving external alarm devices.

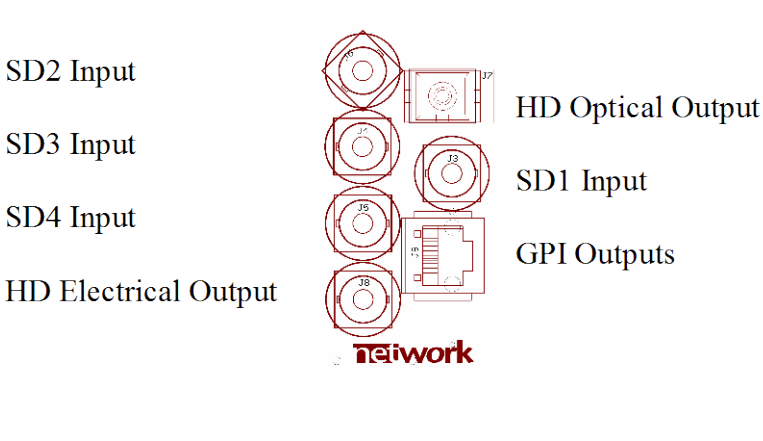


Figure 4: Rear view showing the backplane

Note that the same backplane can be used for both the SDI-TD-MUX-4 board and the SDI-TD-DMUX-4 board.

The following connectors are available:

Name	Description	Connector Type
SD1	Input for 270 Mbps SD-SDI or DVB-ASI.	BNC
SD2	Input for 270 Mbps SD-SDI or DVB-ASI.	BNC
SD3	Input for 270 Mbps SD-SDI or DVB-ASI.	BNC
SD4	Input for 270 Mbps SD-SDI or DVB-ASI.	BNC
HD	Output for 1.485 Gbps HD-SDI (Multiplex according to SMPTE 346M-2000).	BNC
OPT	Optical output for 1.485 Gbps HD-SDI.	SC/UPC
GPI	General Purpose Interface (transistor drivers for external alarm devices).	RJ-45
Note: There are also a number of connectors on the board itself, but none of these are usable to the end-user. For proper operation, make sure there is a jumper in the lower position of the connector located behind the DIP-switches (see Figure 3).		

Unused inputs should be terminated to avoid alarms triggered by noise.

1.3 Power connection

Power is applied to the board via the backplane board, which again is plugged into the power distribution board in the Flashlink rack.

The SDI-TD-MUX-4 board consumes slightly more than the full maximum of 3 watts from the +5V supply and slightly more than the full maximum of 1.5 watts from the +15V supply available at the backplane. This limits the number of boards in a rack to 8 boards plus GYDA-SC, when using a standard single power supply.

Note that the SDI-TD-MUX-4 can also run on a single 5V supply, but then the full power of about 4.5 watts will be drawn from the 5V supply. The board automatically adapts to sharing the load between +5V and +15V when 15V is available.

1.4 Product Variants

SDI-TD-MUX-4	4-ch. SDI time division multiplexer, DVB-ASI compatible, complies with SMPTE 346M-2000, electrical TDM output, ch. swap capability.
SDI-TD-MUX-4-13T	1310nm, -7.5dBm laser + electrical interface
SDI-TD-MUX-4-15T	1550nm, 0dBm laser + electrical interface
SDI-TD-MUX-4-C1270	1270nm, 0dBm CWDM laser + electrical interface
SDI-TD-MUX-4-C1290	1290nm, 0dBm CWDM laser + electrical interface
SDI-TD-MUX-4-C1310	1310nm, 0dBm CWDM laser + electrical interface
SDI-TD-MUX-4-C1330	1330nm, 0dBm CWDM laser + electrical interface
SDI-TD-MUX-4-C1350	1350nm, 0dBm CWDM laser + electrical interface
SDI-TD-MUX-4-C1370	1370nm, 0dBm CWDM laser + electrical interface
SDI-TD-MUX-4-C1390	1390nm, 0dBm CWDM laser + electrical interface
SDI-TD-MUX-4-C1410	1410nm, 0dBm CWDM laser + electrical interface
SDI-TD-MUX-4-C1470	1470nm, 0dBm CWDM laser + electrical interface
SDI-TD-MUX-4-C1490	1490nm, 0dBm CWDM laser + electrical interface
SDI-TD-MUX-4-C1510	1510nm, 0dBm CWDM laser + electrical interface
SDI-TD-MUX-4-C1530	1530nm, 0dBm CWDM laser + electrical interface
SDI-TD-MUX-4-C1550	1550nm, 0dBm CWDM laser + electrical interface
SDI-TD-MUX-4-C1570	1570nm, 0dBm CWDM laser + electrical interface
SDI-TD-MUX-4-C1590	1590nm, 0dBm CWDM laser + electrical interface
SDI-TD-MUX-4-C1610	1610nm, 0dBm CWDM laser + electrical interface

2 Specifications

Electrical input

Number of inputs	4 independent SD-SDI, DVB-ASI or SDTI
Data rates	270 Mbps (Max 35 Mbps active payload for DVB-ASI)
Equalisation	Automatic up to 300m
Impedance	75 ohm
Return loss	>15dB @ 270MHz
Connector	BNC

Electrical output (standard)

Output signal	HD-SDI with TDM payload according to SMPTE 346M-2000
Data rate	1485 Mbps
Impedance	75 ohm
Return loss	>15dB @ 1485MHz
Jitter (UI = Unit Interval)	Max. 0.2UI
Peak to peak signal level	0.8V ±0.1V
Signal polarity	Non-inverting
Connector	BNC

Optical output (option)

Output signal	HD-SDI, TDM payload according to SMPTE 346M-2000
Transmission circuit fibre	Single Mode
Light source	F-P / DFB laser
Optical power	-7.5dBM @ 1310nm (F-P laser), 0 dBm (DFB laser)
Optical centre wavelength	1310nm, 1550nm, CWDM according to ITU-T G.694.2
Max. wavelength drift	±20nm (F-P lasers), ±6nm (DFB lasers)
Jitter (UI = Unit Interval)	Max. 0.2UI @ 1485Mbps
Connector return loss	better than 40dB w/ SM fibre
Connector	SC/UPC

Electrical

Temperature range	0 to +45 °C
Power consumption	+5V/3.5 W, +15V/1.0W (4.5W when running on a single +5V supply)
Control	RS-422, GYDA-SC enabled, SNMP

Latency

Electrical and optical delay	Less than 100 us (combined through MUX and DEMUX) In addition comes 5 us/km of fibre signal propagation time

Standards

Supported standards for electrical and optical ports:

SMPTE	SMPTE 346M-2000, SMPTE 292M, SMPTE 259M, SMPTE 305.2M, SMPTE 297M, SMPTE RP165
DVB-ASI	EN50083-9

3 Configuration

The SDI-TD-MUX-4 is self-configuring in the sense that it will start working according to default factory settings once the input signals and power are applied. Signals will be routed straight through without swapping and SD-SDI/DVB-ASI will be detected and handled automatically.

There are also configuration parameters available via DIP-switches in the front of the board and via the Flashlink-protocol commands from GYDA-SC.

There are two variants of the boards. Early versions (boards with firmware revision (FW) 1.0 and earlier) have full flexibility channel swapping and no other configuration options. Later versions (boards with firmware revision (FW) 2.0 and later) have more functions, but less flexibility on channel swapping.

3.1 Newer boards (FW rev 2.0 and later)

The DIP switches control the channel-to-stream allocation according to the below table. It also controls enable/bypass for the cable equalisers. See also Figure 5 for details on setting the switches.

Note that when GYDA-SC mode is selected, there are no limitations on how the routing and cable equalisers are controlled – as opposed to when operating from DIP-switches.

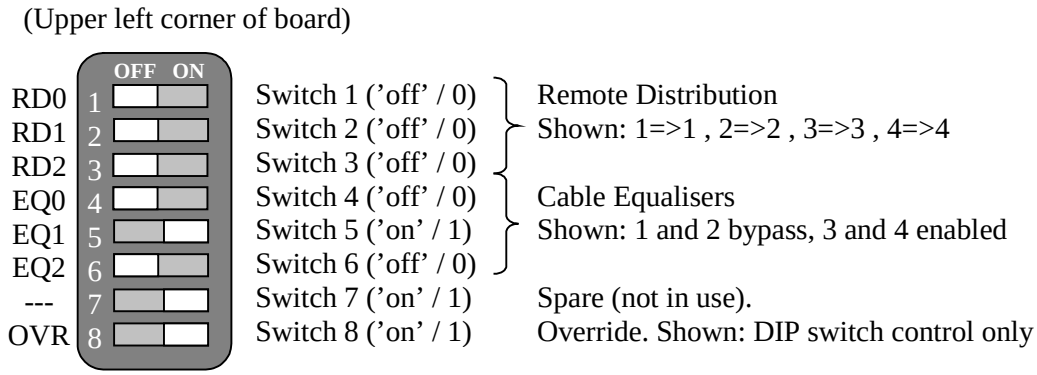


Figure 5: DIP Switch Settings (see also table below)

DIP setting	Description	Comments
RRR----1 (Dashes '-' indicate that these switches are not related to this function).	'RRR' (or RD0-2) are allowing remote control of distribution on the receiver side. Preferably, use the DIP switches on the DEMUX side only or use GYDA-SC, if so is possible in your application. 000: 1=>1 2=>2 3=>3 4=>4 001: 1=>1 1=>2 3=>3 4=>4 010: 1=>1 1=>2 3=>3 3=>4 011: 1=>1 1=>2 1=>3 4=>4 1xx: 1=>1 1=>2 1=>3 1=>4 (Input to stream allocation)	'000' is factory default. See note below.
---EEE-1	'EEE' (or EQ0-2)are controlling the cable equalisers. Leave in position '000' unless you have reasons to turn off cable equalisers. 000: 1=ena 2=ena 3=ena 4=ena 001: 1=byp 2=ena 3=ena 4=ena 010: 1=byp 2=byp 3=ena 4=ena 011: 1=byp 2=byp 3=byp 4=ena 1xx: 1=byp 2=byp 3=byp 4=byp (byp = Bypass , ena = Enabled)	'000' is factory default. See note below.
------S-	'S' is not in use. 0: spare (not in use) 1: spare (not in use) (preferably, leave the switch in the '0'-position)	'0' is factory default.
-------O	'O' is controlling whether the board is controlled by DIP-switches or from GYDA-SC. 0: GYDA-SC control 1: DIP-switch control	'0' is factory default.

Notes regarding distribution and cable equalisers:

- Changing the 'RRR' setting to something else than '000' duplicates input signals on the HD mux-stream and thereby limits the signal options at the receiver (DEMUX) side.
- You may have to swap cables at the rear to get exactly the configuration you are looking for.
- Changing the 'EEE' setting to something else than '000' will bypass one or more of the cable equalisers. This will normally give reduced performance. Only use this feature if you understand why you would want to do it.

On power-on, the actual settings will be according to the dip-switches, except when the GYDA-SC control mode is selected. In that case, the last GYDA-SC setting will be restored from on-board non-volatile memory.

Other board settings available from GYDA-SC:

Control item	GYDA-SC mode DIP = '-------0'	Non-GYDA-SC mode DIP = '-------1'
Laser	Laser can be turned on or off from GYDA-SC. Factory default is 'on'.	Laser always enabled.
EDH counters	Under GYDA-SC control (can be read and reset from GYDA-SC).	Counting still active on the MUX board (on errors), but without any functional significance.
EDH flags	Can be read from GYDA-SC.	Flags still operating on board, but without any functional significance.
EDH masks	Can be changed from GYDA-SC. Not stored in non-volatile memory, so power on default is 'all active', until GYDA-SC configures otherwise.	EDH masks remains unchanged from last setting. Default on power on is all active.
Cable Equalizers	Can be turned on/off from GYDA-SC. Factory default is 'enable'.	Cable equaliser bypass/enable according to DIP-switches. See above table.
Channel swap	Can be controlled by GYDA-SC, all options available.	Channel swap/distribution according to DIP-switches. See above table.

3.2 Older boards (FW rev 1.x and 0.x)

The DIP switches control the channel-to-stream allocation according to the below table. See also Figure 5 for details on setting the switches.

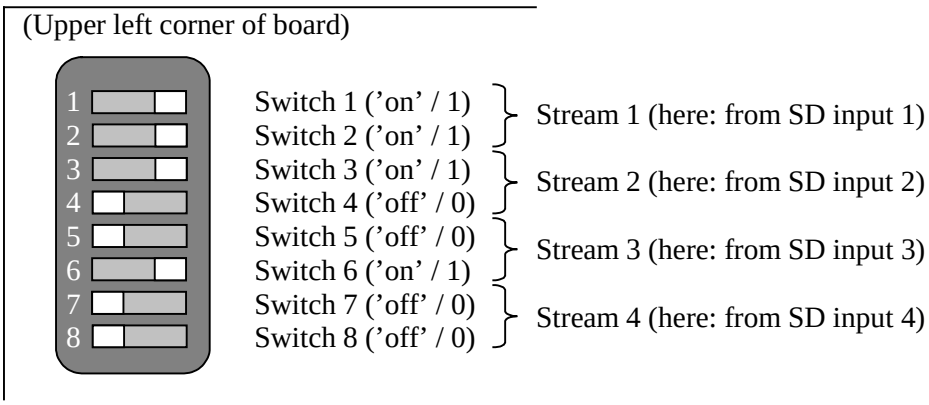


Figure 6: DIP Switch Settings (here: no swap; see example 1 in the below table)

DIP setting	Description	Comments
aaxxxxxx (X is a don't care bit)	aa tells which of the four inputs that are allocated to output stream 1. 00: Input 1 (SD1) 01: Input 2 (SD2) 10: Input 3 (SD3) 11: Input 4 (SD4)	See Figure 6 to understand how the bit-patterns are set.
xxbbxxxx xxxxccxx xxxxxxdd	bb, cc and dd are similar as aa, but for streams 2, 3 and 4 respectively.	
Example 1: 00011011	Input 1 to stream 1. Input 2 to stream 2. Input 3 to stream 3. Input 4 to stream 4.	No channel swapping. See note below.
Example 2: 00110110	Input 1 to stream 1. Input 4 to stream 2. Input 2 to stream 3. Input 3 to stream 4.	
Example 3: 00001111	Input 1 to stream 1. Input 1 to stream 2. Input 4 to stream 3. Input 4 to stream 4.	
Example 4: 11111111	Input 4 to stream 1. Input 4 to stream 2. Input 4 to stream 3. Input 4 to stream 4. Or controlled by GYDA.	See note below.

Note:
The special setting in example 4 above serves dual purposes:

- Allocate inputs to output streams according to the above description.
- Allow GYDA commands to override DIP-setting.

This means that after the DIP-switches are changed from any setting to the 11111111 setting, the above allocations gets active, BUT at the same time allowing GYDA to send commands with any other input-to-stream allocation. So, when this setting is applied to the DIP-switches, the actual configuration depends on GYDA commands.

On power-on, the actual swap setting will be according to the dip-switches, except that when set as in Example 4, the last GYDA command will still be active

The factory default setting will be as in example 4, with last GYDA command stored in non-volatile memory as in example 1. This means that the default start-up is "no channel swapping".

All other DIP switch settings are however 'safe' in the sense that GYDA cannot override these settings.

Other board settings available from GYDA:

Control item	GYDA mode (DIP-sw. = '11111111')	Non-GYDA mode (any other DIP-setting)
Laser	Laser can be turned on or off from GYDA. Factory default is 'on'.	Laser is always on. Both the electrical and optical outputs are active with the same signal at all times.
EDH counters	Under GYDA control (can be read and reset from GYDA).	Counting still active on the MUX board (on errors), but without any functional significance.
EDH flags	Can be read from GYDA.	Flags still operating on board, but without any functional significance.
EDH masks	Can be changed from GYDA. Not stored in non-volatile memory, so power on default is 'all active', until GYDA configures otherwise.	EDH masks remains unchanged from last setting. Default on power on is all active.
Cable Equalizers	Can be turned on/off from GYDA. Factory default is 'enable'.	Always enabled.
Channel swap	Can be controlled by GYDA, as shown in above table.	Channel swap according to DIP-switches. See above table.

4 Operation

The SDI-TD-MUX-4 board transfers any or all of the four 270 Mbps input signals via an optical or electrical HD interface according to SMPTE 346M-2000. An SDI-TD-DMUX-4 board is required to reconstruct the four 270 Mbps signals, normally at a remote location and linked via an optical fibre or an electrical coax cable.

Channel swapping is available either from DIP-switches or remotely via the standard GYDA-SC interface. All inputs can be either 270 Mbps SD-SDI or DVB-ASI (188 or 204 word packets).

5 Front Panel LEDs

Figure 7 shows how the LEDs are located on the front panel.

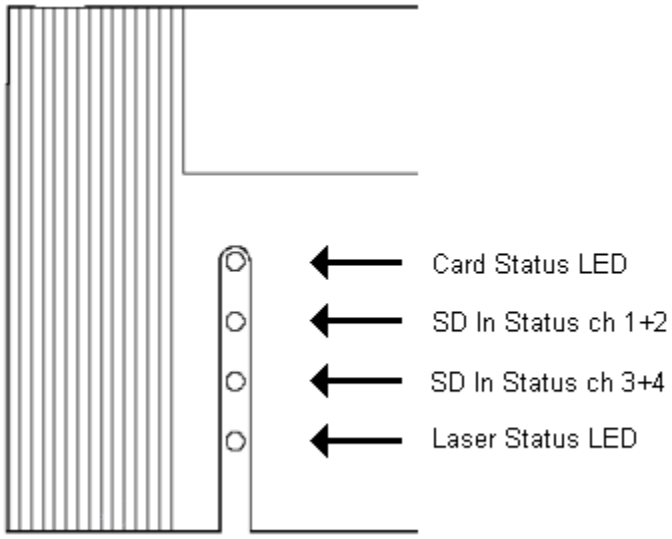


Figure 7: Front Panel View with LED Indicators

The table below shows how the front panel LEDs are to be interpreted.

Note that the term “in error” in the table means that there is either a missing signal (no carrier detect) AND/OR the reclocker has not been able to lock to the incoming signal.

The term “operating normally” means that a signal has been detected (carrier detect on the cable equaliser) AND the reclocker has been able to lock to the signal.

Diode	Description	Red LED	Orange LED	Green LED	No light
1	Card Status	Power on, FPGA not configured	Not applicable	Power on and FPGA configured	No power to board
2	SD IN 1 and SD IN 2	Both channels (1 and 2) in error	One of the channels (1 or 2) in error	Both channels (1 and 2) operating normally	Not applicable
3	SD IN 3 and SD IN 4	Both channels (3 and 4) in error	One of the channels (3 or 4) in error	Both channels (3 and 4) operating normally	Not applicable
4	HD OUT	Output failure	Laser failure	Output OK and laser working	Not applicable

6 GPI alarms

Four alarms are present on the RJ45 connector. These four GPI signals indicate the same status as the LEDs (see above):

- GPI0: On => Power on, FPGA not configured
  Off => Power on, FPGA configured
- GPI1: On => One of the channels (1 or 2) in error
  Off => Both channels (1 and 2) are OK
- GPI2: On => One of the channels (3 or 4) in error
  Off => Both channels (3 and 4) are OK
- GPI3: On => Laser Failure
  Off => Laser OK

An active alarm condition means that the transistor is conducting. The power present alarm should always be active during normal operation.

6.1 GPI/ Data connections RJ45

The below table show the signals available on the GPI connector on the backplane.

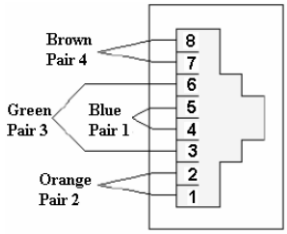


Figure 8: RJ45 Connector for GPI Signals

RJ45 Pin Number	Description
8	GND
7	Not Used
6	Not Used
5	Not Used
4	GPI2
3	GPI3
2	GPI0
1	GPI1

7 GYDA-SC Interface

Figure 9 shows how GYDA-SC will present a rack equipped with an SDI-TD-MUX-4 module in rack position 2, an SDI-TD-DMUX-4 module in rack position 6, a GYDA-SC module in rack position 9 and a power supply unit in rack positions 10 and 11. For details on the GYDA-SC graphical user interface or the communication protocol, refer to the GYDA-SC documents or contact our support department at support@network-electronics.com. For information on which parameters are controllable from GYDA-SC, refer to section 3 of this manual.

Figure 9: GYDA-SC presentation of rack with an SDI-TD-MUX-4 module in position 2

8 Laser safety precautions

These are guidelines to limit hazards from laser exposure.

All the available EO (including ETH100) units in the Flashlink range include a laser.

Therefore this note on laser safety should be read thoroughly.

The lasers emit light at wavelengths from 1270nm up to 1610nm. This means that the human eye cannot see the beam, and the blink reflex cannot protect the eye. (The human eye can see light between 400 nm to 700 nm).

A laser beam can be harmful to the human eye (depending on laser power and exposure time). Therefore:

> Be careful when connecting / disconnecting fibre pigtails (ends).
>
> Never look directly into the pigtail of the laser/fibre.
>
> Never use microscopes, magnifying glasses or eye loupes to look into a fibre end.
>
> Use laser safety goggles blocking light at 1310 nm and at 1550 nm

Instruments exist to verify light output power: Power meters, IR-cards etc.

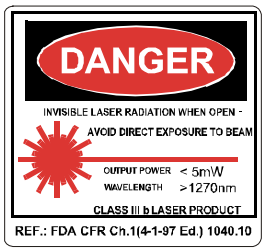
Flashlink features:

All the laser module cards in the Flashlink product range, are Class 1 laser products according to IEC 825-1 1993, and class I according to 21 CFR 1040.10 when used in normal operation.

More details can be found in the user manual for the FR-2RU-10-2 frame.

Maximum output power[1]: 5 mW

Operating wavelengths: > 1270 nm



[1] Max power is for safety analysis only and does not represent device performance.

General environmental requirements for Network Electronics equipment

1. The equipment will meet the guaranteed performance specification under the following environmental conditions:
   - Operating room temperature range: 0°C to 45°C
   - Operating relative humidity range: up to 90% (non-condensing)

2. The equipment will operate without damage under the following environmental conditions:
   - Temperature range: -10°C to 55°C
   - Relative humidity range: up to 95% (non-condensing)

Product Warranty

The warranty terms and conditions for the product(s) covered by this manual follow the General Sales Conditions by Network Electronics ASA. These conditions are available on the company web site of Network Electronics ASA:

www.network-electronics.com

Appendix A Materials declaration and recycling information

A.1 Materials declaration

For product sold into China after 1st March 2007, we comply with the “Administrative Measure on the Control of Pollution by Electronic Information Products”. In the first stage of this legislation, content of six hazardous materials has to be declared. The table below shows the required information.

組成名稱 Part Name	Toxic or hazardous substances and elements					
	鉛 Lead (Pb)	汞 Mercury (Hg)	镉 Cadmium (Cd)	六价铬 Hexavalent Chromium (Cr(VI))	多溴联苯 Polybrominated biphenyls (PBB)	多溴二苯醚 Polybrominated diphenyl ethers (PBDE)
SDI-TD-MUX-4	O	O	O	O	O	O
O: Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in SJ/T11363-2006. X: Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement in SJ/T11363-2006.						

This is indicated by the product marking:

A.2 Recycling information

Network Electronics provides assistance to customers and recyclers through our web site http://www.network-electronics.com. Please contact Network Electronics’ Customer Support for assistance with recycling if this site does not show the information you require.

Where it is not possible to return the product to Network Electronics or its agents for recycling, the following general information may be of assistance:

- Before attempting disassembly, ensure the product is completely disconnected from power and signal connections.
- All major parts are marked or labelled to show their material content.
- Depending on the date of manufacture, this product may contain lead in solder.
- Some circuit boards may contain battery-backed memory devices.

EC Declaration of Conformity

MANUFACTURER	Network Electronics ASA P.B. 1020, N-3204 SANDEFJORD, Norway	
AUTHORISED REPRESENTATIVE (Established within the EEA)	Not applicable	
MODEL NUMBER(S)	SDI-TD-MUX-4	
DESCRIPTION	Time Division Multiplexer	
DIRECTIVES this equipment complies with	LVD 73/23/EEC EMC 2004/108/EEC	
HARMONISED STANDARDS applied in order to verify compliance with Directive(s)	EN 55103-1:1996 EN 55103-2:1996 EN 60950-1:2006	
TEST REPORTS ISSUED BY	**Notified/Competent Body**	**Report no:**
	Nemko	E07381.00
TECHNICAL CONSTRUCTION FILE NO	Not applicable	
YEAR WHICH THE CE-MARK WAS AFFIXED	2008	
TEST AUTHORIZED SIGNATORY		
MANUFACTURER	**AUTHORISED REPRESENTATIVE (Established within EEA)**	**Date of Issue**
		2008-04-08
		Place of Issue
	Not applicable	Sandefjord, Norway

NETWORK ELECTRONICS ASA
O.nr. 976 584 201 MVA

Name Thomas Øhrbom

Position Quality Manager
(authorised signature)

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